

Alaska and the New Maritime Arctic Executive Summary

Executive Summary of a Project Report to the
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Professor Lawson W. Brigham
University of Alaska Fairbanks
School of Natural Resources and Extension



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Project Leader: Dr. Lawson W. Brigham

Project Contributors: Jon Skinner, Wanda Tangermann, John Walsh, Captain Ed Page, Sarah Barton, Nils Andreassen, Mike Sfraga, Geoffrey Cooper, Tracy Rogers, Tom Kurkowski, Matt Leonawicz, Angelica Floyd, Natalie Novik, Scott Stephenson, Felix Tschudi, Henrik Falck, Tommy Flakk.

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INTRODUCTION

Globalization and climate change are impacting the maritime Arctic in extraordinary ways early in the 21st century. The Arctic is increasingly linked to future global markets by the development of offshore and onshore natural resources. These developments require Arctic marine transportation systems that are safe and reliable, and a host of infrastructure improvements to ensure safety and efficiency. This fact is especially true in the U.S. maritime Arctic off the coast of Alaska where there is very limited marine infrastructure. The rapid changes in the Arctic pose an array of challenges and implications for the maritime Arctic of the United States and the State of Alaska. Offshore hydrocarbon exploration and

increased marine traffic along Russia's Northern Sea Route are bringing new and extended seasonal marine operations to the region. The absence of and any international rules and standards will change on 1 January 2017 when a new, mandatory International Maritime Organization (IMO) Polar Code (for ships operating in polar waters) will come into force. This project report explores several key challenges and opportunities that the State of Alaska and the U.S. confront in taking advantage of the economic opportunities these profound Arctic changes present, as well as responding to environmental security issues that have arisen with increased Arctic marine use.



NANA Development Corporation

KEY DRIVERS OF ARCTIC MARINE TRAFFIC

The Arctic's abundant natural wealth is attracting global attention and simulating a need for transportation systems in the maritime Arctic. Although Arctic sea ice retreat provides for greater marine access, the principal driver of today's increasing Arctic marine traffic is the development of natural resources influenced by global commodity prices, and in the longer-term, scarcer natural resources around the globe. This is the primary driver of increased marine traffic around Alaska and within the U.S. maritime Arctic. The Arctic Council's Arctic Marine Shipping Assessment (AMSA) conducted 2005-09 used a scenarios creation process to identify the main uncertainties and factor shaping the future of Arctic navigation to 2020 and 2050. Among the most influential driving forces of some 120 factors were: global oil prices; new Arctic natural resource discoveries; climate changes severity; a major Arctic marine disaster; transit fees for waterways; global (IMO) agreements on Arctic ship construction rules

and standards; the legal stability and overall governance of Arctic marine use; the economics implications of seasonal Arctic marine operations; and, the entry of non-Arctic flag ships into the maritime Arctic. The AMSA scenarios effort identified two primary drivers as axes of uncertainty in the scenarios matrix used for development of four plausible futures of Arctic marine navigation: *resources and trade* (demand for Arctic natural resources influenced by the uncertainty of global commodities markets and market developments), and the *governance of Arctic marine activity* (the degree of stability of rules and standards for marine use both within the Arctic and internationally). A visible example of the primary driver being natural resource developments can be viewed in the growth of the numbers of tankers, bulk carriers and LNG carriers along Russia's Northern Sea Route.

Arctic Marine Shipping Assessment Scenarios Matrix



ARCTIC MARINE SHIPPING ASSESSMENT (AMSA)

The far reaching study, AMSA, conducted under the Arctic Council's working group Protection of the Arctic Marine Environment (PAME), focused on marine safety and environmental protection issues consistent with the Council's mandate. Ninety-six AMSA findings were presented in the *Arctic Marine Shipping Assessment 2009 Report*; each of these key findings has direct applicability to the U.S. marine Arctic. AMSA's 17 recommendations focus on three interrelated themes;

- (I) Enhancing Arctic Marine Safety;
- (II) Protecting Arctic People and the Environment; and,
- (III) Building the Arctic Marine Infrastructure.

Notable in the AMSA report was a detailed section on the Bering Strait region indicating that the region is a natural chokepoint for maritime traffic, marine mammals, and seabirds. Required in the region are a comprehensive survey of marine use by coastal communities, and identification of areas in the U.S. maritime Arctic that could be considered of heightened ecological and cultural significance.

The AMSA effort can be viewed in three important perspectives: first, as a *baseline assessment* and snapshot of Arctic marine use early in the 21st century; second, as a *strategic guide* to a host of states, Arctic residents, users, stakeholders and actors involved in current and future Arctic marine operations; and, third, as a *policy framework document* of the Arctic Council and the Arctic states focused on protecting Arctic people and the marine environment.

Key Findings of the Arctic Council's Arctic Marine Shipping Assessment (AMSA 2009 Report). All have relevance to the U.S. Maritime Arctic.

Governing Legal Regime ~ The Law of the Sea, as reflected in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), sets out the legal framework for the regulation of (Arctic) shipping according to maritime zones of jurisdiction.

Key Drivers of Arctic Shipping ~ Natural resource development and regional trade are the key drivers of increased Arctic marine activity. Global commodities prices for oil, gas, hard minerals, coal, etc. are driving the exploration of the Arctic's natural wealth.

Destinational Shipping ~ Most Arctic shipping today is destinational (vice trans-Arctic), moving goods into the Arctic for community resupply or moving natural resources out of the Arctic to world markets. Nearly all marine tourist voyages are destinational as well.

Uncertainties of Arctic Navigation ~ A large number of uncertainties define the future of Arctic marine activity including: the legal and governance situation; degree of Arctic state cooperation; climate change variability; radical changes in global trade; insurance industry roles; an Arctic maritime disaster; new resource discoveries; oil prices and other commodity pricing; and, future marine technologies.

Retreat of Arctic Sea Ice ~ Global climate simulations show a continuing retreat of Arctic sea ice through the 21st century; all simulations indicate an Arctic sea ice cover remains in winter.

Arctic Community Impacts ~ Marine shipping is one of many factors affecting Arctic communities, directly and indirectly. The variety of

shipping activities and the range of social, cultural and economic conditions in Arctic communities mean that shipping can have many effects, both positive and negative.

Most Significant Environmental Threat ~ Release of oil in the Arctic marine environment, either through accidental release or illegal discharge, is the most significant threat from shipping activity.

Marine Infrastructure Deficit ~ A lack of major ports and other maritime infrastructure, except for those along the Norwegian coast and the coast of northwest Russia, is a significant factor (limitation) in evolving and future Arctic marine operations.

Lack of Charts and Marine Observations ~ Significant portions of the primary Arctic shipping routes do not have adequate hydrographic data, and therefore charts, to support safe navigation. The operational network of meteorological and oceanographic observations in the Arctic, essential for accurate weather and wave forecasting for safe navigation, is extremely sparse.

Ice Navigator Expertise ~ Safe navigation in ice-covered waters depends much on the experience, knowledge and skills of the ice navigator. Currently, most ice navigator training programs are ad hoc and there are no uniform, international training standards.

Special Areas ~ There are certain areas of the Arctic region that are of heightened ecological significance, many of which will be at risk from current and/or increased shipping.



IMPORTANCE OF THE IMO POLAR CODE

The development of a mandatory IMO Polar Code for ships operating in polar waters is the most critical component in a matrix of strategies and measures to protect Arctic people and the marine environment. A process to develop special rules for ships sailing in polar waters began in the early 1990s with an IMO Outside Working Group of technical experts and polar mariners (meeting from 1993-97). The IMO in 2002 released its *Guidelines for Ships Operating in Arctic Ice-Covered Waters*; however, by 2009 the voluntary measures had been expanded to *Guidelines for Ships Operating in Polar Waters*. This was a fundamental shift from ‘ice-covered waters’ to ‘polar waters’ recognizing that ships operating in remote polar seas, often devoid of adequate charting and key infrastructure, do not have to be sailing in sea ice for higher risks to be present. One of the key outcomes of the Polar Code to be in force in January

2017 will be a set of international and unified (and mandatory or binding) rules and regulations that are non-discriminatory to the global maritime industry. The importance and relevance of the Polar Code to Alaska and the U.S. cannot be overstated. While Russia and Canada each have their own set of special rules and regulations for their Arctic waterways, the U.S. has never developed a separate set of special ship rules or standards for commercial ships in the U.S. maritime Arctic. The new mandatory IMO Polar Code will provide the U.S. Coast Guard with a set of international rules and standards which it can implement for U.S. waters defined as polar within the language of the Code (north of 60 degrees in the Bering Sea). The flag states and port states in the Arctic will be responsible for uniform application and enforcement for all commercial carriers and passenger vessels of more than 500 tons.



Keppel Offshore and Marine, Singapore

U.S. NATIONAL STRATEGY FOR THE ARCTIC REGION

Released by the White House in January 2014 the *Implementation Plan for the National Strategy for the Arctic Region* provides guidance to a host of federal departments and agencies. For the maritime domain, the Plan presents a 10-year horizon that will be used to prioritize federal infrastructure in the U.S. maritime Arctic. This will be a very challenging task given the great number of economic, environmental, and geopolitical uncertainties influencing Arctic marine operations as identified in AMSA. Include in the Plan are major initiatives on: developing telecommunication services; enhancing domain awareness; sustaining Federal capability to conduct maritime operations in ice-covered waters; protecting the Arctic environment and identifying sensitive areas in the U.S. maritime Arctic; increasing charting in the region and improving geospatial referencing; improving oil and other hazardous materials prevention, containment, and response; and, supporting a circumpolar Arctic observing system.

A comparison is made of the AMSA recommendations with themes and key issues with the U.S. *National Strategy for the Arctic Region* signed by President Obama on May 10, 2013. There is an excellent match between the two efforts even though the AMSA recommendations are more focused on marine safety and environmental protection. Nearly all of the AMSA recommendations are mentioned either specifically or in the broader context of a national goal or line of effort. This comparison suggest that the set of AMSA recommendations (which the U.S. agreed to at the Arctic Council) is a tailor made policy framework for the U.S. federal agencies to use in addressing the environmental security challenges in its maritime Arctic at a time of expanding marine use. AMSA represents a reasonable strategic guide for all federal and State of Alaska agencies in addressing in a holistic approach the many marine environmental and safety issues confronting the new maritime Arctic.

**Comparison of the AMSA Recommendations with the Elements of the
U.S National Strategy for the Arctic Region** (Strategy Page Number in Parentheses).

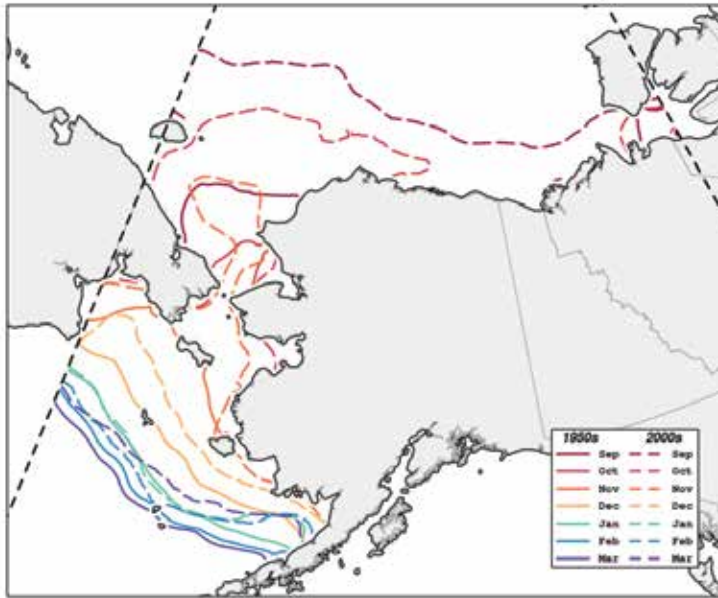
AMSA Recommendations	National Strategy for the Arctic Region
I. ENHANCING ARCTIC MARINE SAFETY	
A. Linking with International Organization	• Strengthening International Cooperation (2)
B. IMO Measures for Arctic Shipping	• Promotion of safe, secure and reliable Arctic shipping, a goal that is the best pursued through the IMO (10)
D. Strengthening Passenger Ship Safety in Arctic Water	• Preserve Arctic Region Freedom of the Seas (6) • Accede to the Law of the Sea Convention (9)
C. Uniformity of Arctic Shipping Governance	
E. Arctic Search and Rescue Instrument	• 2011 Arctic Search and Rescue Agreement (9)
II. PROTECTING ARCTIC PEOPLE & THE ENVIRONMENT	
A. Survey of Arctic Indigenous Marine Use	• Consult & Coordinate with Alaska Natives (11)
B. Engagement with Arctic Communities	• Policy emphasizes trust, respect and shared responsibility (11)
C. Areas of Heightened Ecological and Cultural Significance	• Protect the Arctic Environment and Conserve Arctic National Resources (7)
D. Specially Designated Marine Areas	• Use Integrated Arctic Management to Balance Economic Development, Environmental Protection and Cultural Values (8)
E. Protection from Invasive Species	
F. Oil Spill Prevention	
G. Addressing Impacts on Marine Mammals	• Contribute to the identification of ecologically sensitive areas (8)
H. Reducing Air Emissions	
III. BUILDING THE ARCTIC MARINE INFRASTRUCTURE	
A. Addressing the Infrastructure Deficit	• New thinking on public-private partnerships and multinational partnerships (10) • Carefully tailor regional infrastructure as well as our response capacity (6)
B. Arctic Marine Traffic Systems	• Enhance Arctic Domain Awareness (6) • Develop Arctic waterways management regimes (7)
C. Circumpolar Environmental Response Capacity	• 2013 Arctic Marine Oil Pollution Preparedness and Response Agreement (9) • Capacity to respond to natural and man-made disasters (6)
D. Investing in Hydrographic, Meteorological and Oceanographic Data	• Better earth system-level knowledge (8) • Chart the Arctic region (8)

CHANGING MARINE ACCESS AND SEA ICE

During the last three decades observations have shown that Arctic sea ice has continued to decrease in extent and thickness. However, the Arctic Ocean remains fully or partially ice-covered for much of the winter, spring and autumn. It is an ice-covered ocean that requires international regulation (and standards), not an ice-free environment. Global climate models

simulate a continued reduction of Arctic sea ice extent, and an entirely ice-free Arctic Ocean for a short period of time in summer is projected to occur before mid-century. Such an occurrence would mean that no more multi-year or 'old' sea ice will remain in the Arctic Ocean and the region will be left with a seasonal, first year ice cover in subsequent years.

Mean Decadal 15% Sea Ice Concentration Edge



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

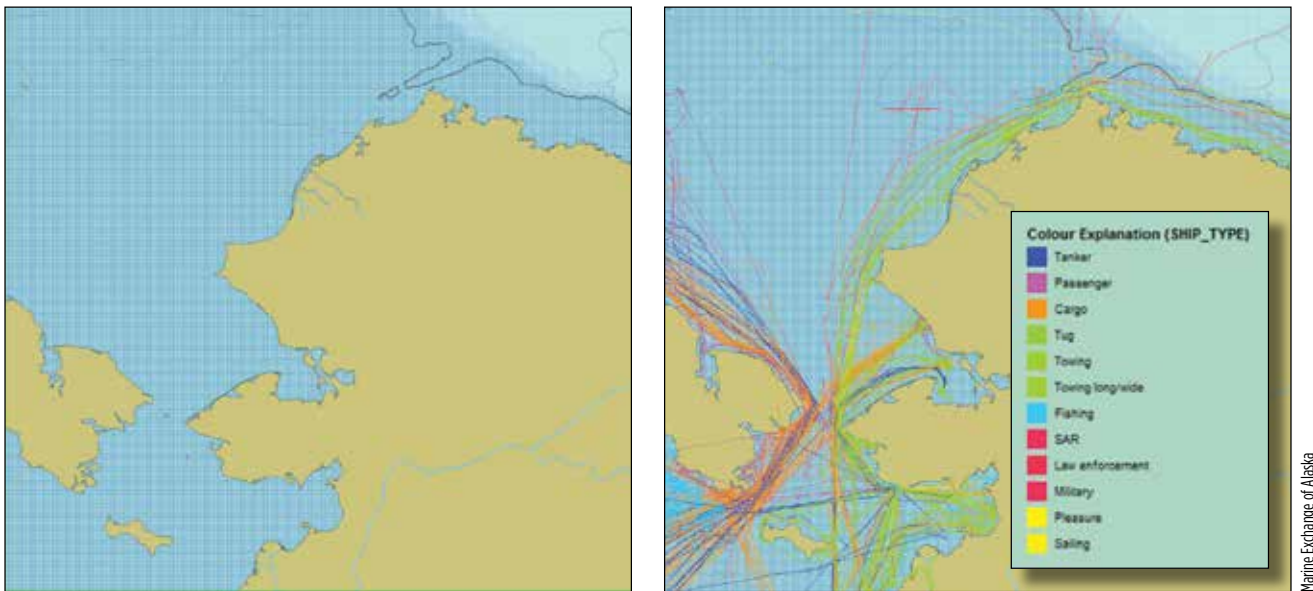
Analyses of the sea ice in the U.S. maritime Arctic (comparing observations of the 1950s with the 2000s) indicate: (1) the Bering Sea maximum ice edge in the winter has not changed significantly for five decades despite regional and global warming; (2) the mean decadal summer ice edges in the Chukchi and Beaufort seas have retreated significantly northward into the central Arctic Ocean during the past five decades. For the U.S. maritime Arctic these trends mean plausible, longer ice-free seasons in the autumn for offshore hydrocarbon exploration and seasonal barge supply of coastal communities. Marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal ice conditions in the region. For six months (December to May) the presence of sea ice hinders or prevents the passage of all but a handful of vessels. The seasonal pattern of U.S. Arctic marine operations is unlikely to change substantially unless federal regulators allow future hydrocarbon exploration and development in ice-covered waters.

MARINE TRAFFIC

The Marine Exchange of Alaska makes use of the Automatic Identification System (AIS) required by IMO for large commercial ships. The AIS data indicates that ship transits in the U.S. maritime Arctic are almost entirely concentrated in the ice-free season (June to November). The AIS data shows that for the Bering Strait region ship traffic begins to appear in late May, peaks in July and August and ends by November. An analysis of U.S. seasonal traffic indicates a high concentration of tugs and barges which is the nature of resupply of coastal communities and the North Slope during summer. There are a small number of bulk cargo carriers (20-28) that sail to Kivilina and carry zinc ore out from the Red Dog Mine complex to global markets. And, the data indicates a small number of coastal tankers in U.S. waters. On the Russian side of the Bering Strait region the Marine Exchange data indicate the summer (June through October) passage of tankers, bulk carriers, liquefied natural gas (LNG) carriers, icebreakers, and support vessels into and out of the Northern Sea Route (NSR). The 2012 traffic data indicate a total of 154 northbound and 162 southbound transits of the Bering Strait region (316 total transits) between 26 June and 18 November; 30 transits are directly attributed to Shell offshore operations during the summer (additional U.S. Coast Guard cutter transits can be correlated to the federal response to Shell's 2012 exploration in the Chukchi Sea. The 2013 marine traffic data for the Bering Strait region shows a slight transit increase from 2012 with 339 ships of all types (167 northbound and 172 southbound).

An analysis of marine traffic was performed for the busiest day of the 2013 navigation season in Bering Strait. There was considerable variability in the ship corridors used within the 23.6 nautical mile distance between the Alaskan mainland and Little Diomed Island. On 25 July 2013 two vessels transited northbound and four transited southbound. During the 2013 navigation season there were many days when only one or two ships transited the Bering Strait region on the U.S. side. Off Point Barrow during the 2013 navigation season there were 124 vessels transiting (69 westbound and 55 eastbound); most transits were within 30 nautical miles of Point Barrow and a majority within 10 nautical miles.

In summary marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal ice conditions and a six-month navigation in ice-free waters is normal. Most of the ship traffic moving north through Bering Strait on the U.S. side is coastal and domestic, or cabotage (tug-barge operations). The Red Dog Mine operation brings bulk carriers (20-28 large ships) to the U.S. maritime Arctic during a short summer navigation season. Shell's 2012 offshore hydrocarbon exploration efforts in the Chukchi and Beaufort seas accounted directly and indirectly for approximately 60 seasonal north and southbound transits through the Bering Strait region.



Maritime traffic in the Bering Strait & northwest Alaska region. Left: 1 January to 31 May 2013. Right: 1 June to 30 November 2013.

NORTHERN SEA ROUTE AND NORTHWEST PASSAGE DEVELOPMENTS

The paradox of the opening of Russia's Northern Sea Route (NSR) is that it provides both a potential economic opportunity for Alaska and an environmental security challenge to the Bering Strait region. An increase in the length of the NSR summer navigation season provides a more reliable operational timeframe to potentially ship Alaska's natural resources to European markets. Zinc ore from the Red Dog Mine complex and coal from northwest Alaska (if developed) could be shipped along the NSR in summer by bulk carriers. It is also plausible that lower transportation costs could be realized in summer by shipping Alaskan seafood products along the NSR to key markets in central and western Europe. However, it is not likely the NSR will be functioning year-round in its eastern seas and a 5-6 month navigation season is envisioned for the coming decades. *Therefore any NSR shipping opportunities to and from Alaska (between the Atlantic and Pacific) must be conceived and evaluated to be economically viable on a seasonal basis.* The fundamental driver of the NSR remains Arctic natural resource development, especially the pace of that development in the Russian Arctic. The development of a major port on the Yamal Peninsula (Sabetta) is a strategic location to facilitate the shipping of LNG eastward along the NSR to Asia Pacific ports in an extended summer navigation season; the port can also operate year-round with LNG carriers sailing westward to European ports and potentially to ports in North and South America.



TSCHUDI

Future marine routes to global markets out of the Port of Sabetta (Yamal Peninsula) in the Russian Arctic.

The NSR faces a number of significant challenges including:

- Determining a viable fee system for services provide on NSR voyages;
- Replacement of the Russian icebreaker fleet which plays a key role in the escort of ship convoys;
- Application of the new IMO Polar Code to the operation and regulation of the NSR;
- The pace of Russian Arctic maritime infrastructure to enhance marine safety and environmental protection along the NSR;
- How the marine insurance industry and underwriters will deal with risk management for ship voyages along the NSR; and,
- Establishment of a reliable length of the navigation season so that shippers can create a viable and economic operating season.

The Canadian Arctic and Northwest Passage (NWP) present many challenges to future Arctic marine navigation. It is remarkable that since the first NWP complete transit (1903-06 by the Norwegian Amundsen), only 184 complete transits have been accomplished by the end of the 2012 season. A majority of recent voyages have been conducted by adventurers in small vessels sailing in minimal summer ice conditions. One key issue limiting commercial traffic has been the observed record of high year-to-year variability of sea ice coverage. The complexity of the various routes of the NWP, draft restrictions, highly variable and difficult sea ice conditions (present for 9-10 months), lack of marine infrastructure, lack of comprehensive charting, and high operational costs (including marine insurance) are all factors that make regular commercial traffic through the Canadian Arctic uncertain at best. Anticipated increases in marine shipping in the region are related to future mining developments in the Canadian Arctic and thus linked to global commodities prices. The linkages of the NWP to the U.S. maritime Arctic will not likely yield a flow of large commercial ship traffic in the decades ahead. Relatively modest numbers of support vessels, research ships, adventurers and small cruise ships will cross the U.S. maritime Arctic on their voyages to and from the Canadian Arctic and the multiple routes of the NWP.



LINKS TO U.S. ARCTIC OFFSHORE DEVELOPMENT

Oil and gas exploration/production will be the primary driver of any significant increases in ship traffic through Bering Strait and in the U.S. maritime Arctic. This is highly probable for the next 10 years; it is also likely that the hydrocarbon industry will remain the biggest driver of shipping and marine operations in the U.S. maritime Arctic for the next 30 years, though the less defined impact of currently undeveloped mining enterprises could also have a significant impact. The proposed Shell drilling plan of August 2014 envisions an armada of 25 support ships for two drilling vessels during a six-year exploratory drilling phase. It is plausible that high success by Shell in this phase could induce accelerated activity by other major lease holders in the Chukchi Sea (Statoil and BP). Production success in the Chukchi Sea could also renew interest in the offshore Beaufort Sea outer continental shelf (OCS) lease areas. Moving to the production phase in the OCS Chukchi Sea areas would likely entail construction of platforms that would be serviced by pipelines to shore. Pipe laying vessels and other support ships would increase ship traffic in Chukchi Sea and through Bering Strait, and increase seasonal marine operations throughout the region. In the transition from the exploratory phase to the production phase, there would be a plausible spike in offshore operations ramping up to platform installation and support. The transition period can be expected to last a decade, in which drilling activity could increase from five to approximately over 30 wells per year.

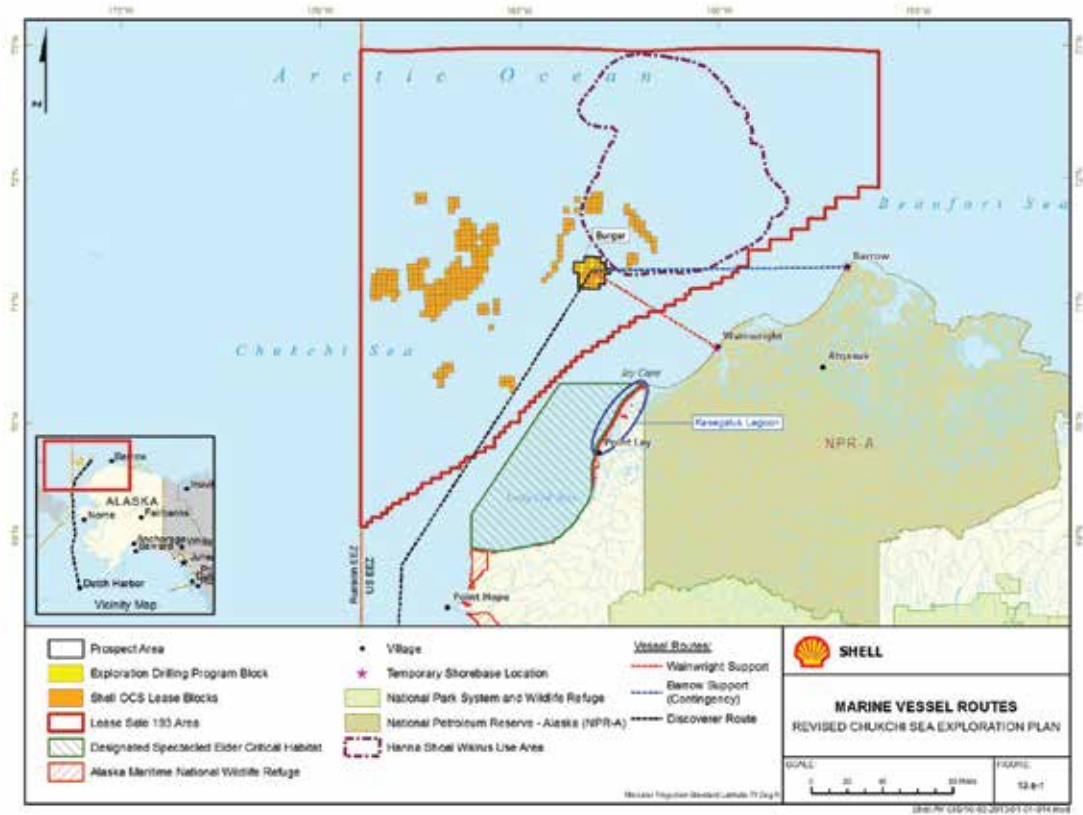
An approximation of the future of OCS development in the Chukchi Sea assumes eight platforms in production operations by 2025 and some fifteen subsea interconnected templates. Using the support fleet requirements proposed by Shell in its 2014 plan, approximately 100 support vessels could

be operation within the lease areas (12 per drilling rig required in Shell's exploration plan). This could directly relate to an increase of 100 seasonal transits of Bering Strait. Another option could be the sustained harboring of some of these vessels in a location north of Bering Strait. During the peak of marine operations the required support fleet could grow to as many as 150 vessels to construct the platforms, lay pipelines on the seabed and develop the support infrastructure to the offshore. In summary future OCS development in the Chukchi Sea can drive greatly increased marine traffic in the region.



Shell Gulf of Mexico Inc.

Chukchi Sea Outer Continental Shelf Exploration and Operational Plan by Shell



U.S. MARITIME ARCTIC INFRASTRUCTURE NEEDS

The U.S. maritime Arctic is generally understood to lack a broad array of marine infrastructure to support long-term economic opportunities and address key environmental security challenges. Seven key requirements include:

Hydrography and Charting ~ Having modern marine charts is fundamental to providing a safe operating environment and for facilitating coastal development of ports and navigable waterways. This is key, specific requirement that is recognized in the *National Strategy for the Arctic Region*. Mapping the entire U.S. maritime Arctic to attain international navigation standards in this large region will require significant, long-term funding for NOAA. The NOAA budget for geodetic referencing in Alaska, shoreline surveys, and hydrographic surveys must be increased for the long-term so that an adequate safety net can be established in America's Arctic coastal regions.

Arctic Observing Networks ~ Investment in the international Sustaining Arctic Observing Network (SAON) by the Arctic and non-Arctic states should be considered an investment in enhancing Arctic marine safety and environmental protection. SAON would be an important advance in enhancing safety and environmental response especially in the Bering Strait region and across the U.S. maritime Arctic. Providing advanced and timely environmental information to Arctic coastal users and stakeholders is a critical requirement for the U.S. maritime Arctic. The U.S. has developed the Alaska Ocean Observing System (AOOS) with NOAA funding as part of a national-regional partnership (the Integrated Ocean Observing System). AOOS has four areas of focus: safe marine operations; coastal hazard mitigation; tracking ecosystem and climate trends;

and, monitoring water quality. Long-term funding for AOOS is crucial to maintaining adequate observations in the remote and sparsely monitored northwest Alaska coast and regional seas.

Marine Domain Awareness ~ Strengthening the systems for the monitoring and surveillance of ships, pollution, and emergency situations in the Arctic is of paramount concern for the Department of Homeland Security, the U.S. Coast Guard and a host of federal and State of Alaska agencies. To be effective, Marine Domain Awareness (MDA) requires the integration of information from many data categories: vessels; cargo; maritime personnel and organizations; infrastructure; and the environment. Two of the key challenges to enhanced MDA are its complexity and the expanse of the marine environment; the remoteness and harsh operating environment of the maritime Arctic add considerably to monitoring and surveillance requirements. The Marine Exchange of Alaska provides key ship traffic information to the maritime industry, the Coast Guard, and the State of Alaska. Investment is required for improved communication networks, effective maritime tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring in northern latitudes, and additional AIS land-based receiving sites.

Alaskan Arctic Deepwater Port ~ A recent joint federal-state study conducted by the U.S. Army Corps of Engineers and the Alaska State

Department of Transportation and Public Facilities (*Alaska Deep-Draft Arctic Port System Study*) underscored the long-term need for a U.S. Arctic port that would be linked to natural resource export in a new era of demand for Arctic resources by global markets. Future scenarios out 50 years were created with two key driving forces emerging: Arctic natural resource development and collaborative investment (public and private investment). Recommendations of the study included: public-private partnerships to finance the construction of an Arctic port and associated infrastructure; increased funding for NOAA for hydrographic and bathymetric surveys; and, needs for navigational tools to support Arctic infrastructure developments.

Search & Rescue and Environmental Response Capacity ~ Locating adequate Coast Guard search & rescue (SAR) and environmental response units closer to the U.S. maritime Arctic is a logistical and funding challenge. The vast size and remoteness of the northern coast of Alaska places a premium on the use of mobile ship assets rather than shore facilities. The maintenance of a physical presence of the Coast Guard within the U.S. maritime Arctic will become a more urgent requirement when offshore oil and gas exploration increases. The use of seasonal deployments of small boats and helicopters to coastal communities will likely be one strategy to employ. Long-term planning for strategically-positioned shore facilities includes the possible co-location of response assets at a future Arctic port.

Polar and Coastal Icebreaking Capacity ~ The replacement of America's polar icebreakers (the two *Polar Class* ships, *Polar Star* and *Polar Sea*) has been a long-standing issue. However, this requirement for federal icebreaking capacity in large, high powered ships, masks a plausible need for shallower-draft, but ice capable (smaller) Coast Guard cutters for operations in the coastal areas of northwest Alaska and the Beaufort Sea. The United States has national interests in the

Arctic and Antarctic and Coast Guard polar icebreakers (past and current) provide visible and effective strategic maritime presence in these remote regions. Within the territorial sea and exclusive economic zone around Alaska, the Coast Guard's polar icebreakers provide a credible, sovereign presence and a platform for law enforcement, SAR, emergency response, scientific research, and any special maritime operation required in ice-covered waters. The role of commercial ship escort by icebreaker in U.S. waters requires re-examination in the light of advances in Arctic marine technologies and new operational strategies. Most of today's Arctic commercial ships are designed as icebreaking ships capable of independent operations (without icebreaker escort). Most of the Arctic commercial carriers operating in the Canadian and Russian Arctic regions do not require icebreaker escort during a 3-4 month navigation season. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response and research) and commercial icebreakers in support of economic development of Alaska's Arctic (offshore hydrocarbon exploration and escort of commercial carriers if needed).

Arctic Transportation Corridors ~ Transportation systems, or corridors, have been advocated for the U.S. Arctic, particularly along Alaska's west coast and North Slope. Existing infrastructure relies on shallow-draft barges. The systems or corridors would be a mix of all modes of transportation: roads, rail, marine, air, pipelines, and energy. Three corridors have been proposed: (1) a Northern Shipping Corridor with services to include traffic monitoring, SAR, spill response, and salvage; (2) A North Slope Corridor, a multi-modal transportation system focused on oil and gas production; and (3) a Western Arctic Corridor, a multi-modal transportation system with offshore development and onshore mining.

MARITIME WORKFORCE POTENTIAL

Alaska's maritime employment opportunities are heightened in light of the potential increases in Arctic activity during the coming decades. A majority of recent reports note that an expansion of skilled labor force is necessary to capitalize on the future economic potential and even to maintain the status quo due to the aging of the workforce. OCS development could generate 35,000 new jobs over the next 50 years with a cumulative payroll of \$72 billion dollars. OCS exploration and development of oil and gas is the primary sector requiring substantial additional workforce and training. State support for OCS development is a key arena for intervention to expand the economic opportunity

and the need for a skilled workforce. It is clear from several studies that the existing population of Alaska cannot meet the potential demand for a skilled workforce (for replacement of an aging workforce or to capture skilled OCS jobs if they emerge). Developing training and career pathways is a long-term process. Inventories and pathways are in place in many occupations, but there is no specific implementation leadership and strategic plans to strengthen these in the future. The uncertainty in the timing of development of the U.S. Arctic presents multiple challenges to defining new opportunities for marine occupations and support industries in Alaska.



MAJOR FINDINGS OF THE STUDY AND INTERNATIONAL WORKSHOP

1. Arctic natural resource development is primary driver of the need for Arctic marine transportation systems. This finding is consistent with recent marine traffic along the Northern Sea Route and in other Arctic regions, and also consistent with a key finding of the Arctic Council's Arctic Marine Shipping Assessment.
2. The Arctic Ocean is an ice-covered ocean that requires international (ship) rules, regulations and standards, not an ice-free environment. There are no current Arctic-specific rules and regulations (domestic or international) that are applied to the U.S. maritime Arctic.
3. The Arctic Council's Arctic Marine Shipping Assessment (AMSA) provides a solid framework and strategy for enhancing marine safety and environmental protection in the U.S. maritime Arctic. AMSA's 17 recommendations formulated within three themes (Enhancing Marine Safety; Protecting Arctic People and the Environment; and, Building the Arctic Marine Infrastructure) is a blueprint for Federal and State of Alaska agencies.
4. The AMSA recommendations are compared (Table 1.2) with the themes and key issues within the U.S. National Strategy for the Arctic Region issued in 2013. There is an excellent match between these two efforts; all of the 17 AMSA recommended actions are mentioned either specifically or in the broader context of a national goal or line of effort.
5. The mandatory International Maritime Organization's Polar Code for ships operating in polar waters will be critical to enhancing the protection of Arctic peoples and the marine environment within the U.S. maritime Arctic and throughout the Arctic Ocean. Since the U.S. has never developed a separate set of Arctic-specific ship rules for its Arctic waters (as have Canada and Russia), the Polar Code to be implemented between May 2015 and 1 January 2017 fills that critical need for U.S. Arctic waters.
6. The U.S. must fully implement in its maritime Arctic the elements (including response infrastructure) of two binding Arctic agreements: the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011); and, the Agreement on Maritime Oil Pollution Preparedness and Response in the Arctic (2013). The elements

and requirements of both Arctic treaties need to be integrated into U.S. strategies and plans for emergency response in the U.S. maritime Arctic.

7. The new *Historical Sea Ice Atlas for Alaskan Waters* is a key strategic resource for evaluating past changes in sea ice within the U.S. maritime Arctic. The database in the Atlas can be used to determine periods and any trends in ice-free conditions around Alaska.
8. The seasonal Arctic sea ice edge in the Bering Sea at its maximum in the spring (March and April) has not changed substantially during the past five decades. Earlier seasons of navigation (in ice-free conditions) in the spring are not anticipated for the coast of Alaska.
9. The seasonal Arctic sea ice edge in the Chukchi and Beaufort seas at its minimum in the autumn (September) has retreated dramatically during the past five decades. Once located in the Chukchi Sea in September in the 1950s, the ice edge has retreated hundreds of nautical miles north of Alaska's coast. Later seasons of navigation (in ice-free conditions) in the autumn are anticipated in the Beaufort and Chukchi seas for offshore drilling operations and coastal resupply.
10. Increases in Arctic marine traffic in the U.S. maritime Arctic and the Bering Strait region during the last five years has been driven by offshore hydrocarbon exploration and the

growth in numbers of ships along the Northern Sea Route that are carrying Arctic natural resources to global markets. Hydrocarbon activity in the U.S. maritime Arctic will likely remain the most significant factor in increases in marine operations for at the next several decades.

11. Marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal sea ice conditions in the region. For six months (December to May) the presence of sea ice hinders or prevents the passage of all but a handful of vessels from sailing in these waters. This seasonal pattern of U.S. marine operations is unlikely to change unless federal regulators allow future hydrocarbon exploration and development in ice-covered waters.
12. The vast majority of the marine traffic in the U.S. maritime Arctic consists of tugs, barges, support vessels, federal vessels, research ships, and a handful of small cruise ships. The only large commercial ships in the region are sailing to the terminal at Kivilina (for the export of zinc ore from the Red Dog Mine) and occasional small tankers in Alaskan coastal waters. Future increases in traffic during the next two decades are expected to be drill ships and support vessels related to U.S. offshore hydrocarbon exploration and development.
13. A majority of marine traffic along the Russian coast of Bering Strait consists of tankers, bulk carriers, LNG carriers, ice-breakers and ice capable support vessels that are using the

Northern Sea Route. Increases in the length of navigation season for the Northern Sea Route (beyond six months) could lead to increases of marine traffic in ice-covered waters of the Bering Sea region during the months of December and June. There are no indications today that the navigation season in the Laptev, East Siberian and Chukchi seas of the Northern Sea Route will be extended beyond six months.

14. Arctic shipping routes are unlikely to revolutionize the global container shipping trade routes. The Northern Sea Route is viewed by Russian and international experts as a seasonal supplement to the Suez Canal route. The NSR will not replace the Suez or Panama canals, but should be viewed as a viable and new seasonal alternative marine route despite key constraints such as: the variability of regional sea ice, shallow water depths in select straits, a high fee system, and lack of marine infrastructure.
15. Hydrocarbon activity in the offshore Russian Arctic is not likely to significantly increase NSR shipping or otherwise impact the U.S. maritime Arctic for the next decade or more.
16. The Northern Sea Route is emerging as a seasonal (summer) Arctic shipping route with significant potential for destination shipments of Arctic natural resources out of the Russian Arctic and northern Europe to global markets especially in the Pacific. There may also be opportunities for trans-shipment of natural resources (such as iron ore).
17. An opportunity exists for both Norwegian and Alaskan maritime interests to use the Northern Sea Route for trading during summer and as a marine connection between Europe, northern Norway, and Alaska. Enhanced cooperation with Norway on Arctic marine transportation (and international trade) issues will be mutually beneficial.
18. The Aleut Corporation and Adak should establish links with Russian Arctic oil and gas interests in Yamal (particularly out of the new port of Sabetta). The objective would be to explore the potential for oil and gas deliveries along the Northern Sea Route to Adak for possible servicing western Alaska communities.
19. Due to its complex geography, highly variable sea ice environment, short navigation season, and lack of infrastructure, the Northwest Passage (NWP) does not have the same level of interest by global shipping interests and investment as the Northern Sea Route. There are no indicators that large numbers of commercial carriers will be making full transits of the NWP and sailing to/from the U.S. maritime Arctic during the next two decades.
20. The Chukchi Sea Outer Continental Shelf (OCS) has an estimated potential of total oil reserves of 15 billion bbls, approximately double the potential for the Beaufort Sea OCS, and is currently the only lease area in the Alaska OCS with an exploration plan submitted for approval. By comparison, the

total production from Prudhoe Bay during the last 35 years has been approximately 17 billion bbls.

21. For the next six years offshore hydrocarbon development in the OCS will remain in an exploratory drilling phase, if it proceeds at all under the current regulatory regime. These operations are well characterized in Shell's proposed exploratory drilling plan of August 2014. That plan envisions a support armada of approximately 25 supporting ships for two drilling vessels and double the vessel transits out to the drill ships during operations.
22. Canadian-driven exploratory oil and gas drilling and its support marine operations (in the Beaufort Sea) do not appear an immediate or significant marine traffic factor for the U.S. maritime Arctic within the next ten years.
23. Exploration and drilling ashore in the Arctic petroleum Reserve would likely have modest impact on marine traffic as plans include overland access to position equipment (seasonal ice roads) for pipeline construction. Unlike the Trans-Alaska Pipeline System (TAPS) in the early 1970s, an overland corridor now exists for much of the logistical requirements (along the Dalton Highway).
24. Assuming eight platforms in production operations in the Chukchi Sea OCS in 2025, and their 15 subsea interconnected templates (as a benchmark), with a comparison of the support fleet requirements in the Shell 2014 plan, approximately 100 support vessels could be in operation in the lease areas. This would translate to approximately 100 Bering Strait seasonal transits. These estimates provide some measure of the future level of traffic associated with offshore development in the U.S. maritime Arctic.
24. The necessary legal and structural preconditions required to set the stage for increased economic development in the U.S. maritime Arctic are not yet in place.
25. The U.S. maritime Arctic is essentially void of crucial marine infrastructure. Substantial investments and future public-private partnerships will be essential to provide adequate funding for a robust safety net and for facilitation of regional economic development.
26. A major Arctic port in western Alaska is a key to regional economic development, servicing the offshore hydrocarbon industry, export of Alaska's natural resources/wealth to global markets, and connections to the new maritime Arctic. Intermodal links (road, rail, air) to those resources are essential to the economic viability of an Arctic port in western Alaska.
27. Hydrography and charting of the U.S. maritime Arctic is critical to safe navigation, and for facilitating coastal development of ports and navigable waterways. NOAA's federal budget for hydrographic surveys, shoreline surveys, and geodetic

referencing in Alaska is essential to America's Arctic environmental and economic security.

28. Strengthening and investing in the monitoring and surveillance of marine traffic in the U.S. maritime Arctic and Bering Strait region is of paramount importance. A critical component of marine domain awareness in the region is the Marine Exchange of Alaska which derives some operating costs from the U.S. Coast Guard and State of Alaska. Two key users and stakeholders of the Exchange's real-time database. The region requires improved communication networks, effective tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring, and additional AIS land-based receiving sites.
29. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response, and research), and commercial icebreakers in support of economic development of the U.S. Arctic (supporting offshore hydrocarbon exploration and the occasional escort of commercial carriers). Most of the modern Arctic commercial carriers are icebreakers in their own right and are designed for independent operations, a finding of the Arctic Marine Shipping Assessment. Few of these modern polar ships will require routine icebreaker escort in the U.S. maritime Arctic, but assistance might be required in emergency situations.
30. Arctic environmental observations are crucial to understanding the changing regional climate and supporting marine operations. Investment in the Sustaining Arctic Observing Network (SAON) by the U.S. should be considered a long-term investment in enhancing marine safety and environmental protection. A multi-national, coordinated network designed for monitoring regional climate change and local environmental conditions will have synergies and direct value to a myriad of operational requirements to increased Arctic marine traffic.
31. The international workshop held during the project concluded that a number of preconditions must exist for investment in Alaska: broadband telecommunications; regulatory certainty; public and private partnerships; year-round all-weather airports statewide (in place); tax structures and incentives; education and workforce training; enhanced working relations with Canada and Russia; improved State and federal working relationships; and, a major oil discovery in the Chukchi Sea or Cook Inlet (a catalyst for investment).
32. Federal support for Arctic marine infrastructure is anticipated to be limited for the next ten years or more. Nonetheless, there is much active planning on key topics such as Arctic deep-draft port development, maritime safety, and information infrastructure. All Arctic marine infrastructure investments by the federal government will have direct influences on the long-term economic development of America's Arctic.

33. More capacity for oil spill response capability must be established north of Dutch Harbor. Focus should be on the near-shore environment of western Alaska. Response systems must utilize local knowledge and hold enhanced training sessions in coastal communities. Response equipment must be strategically located in coastal ports and communities, especially in areas of current and future offshore hydrocarbon development and increased marine traffic.

34. Only offshore Arctic hydrocarbon exploration and development will likely drive significant expansion of a skilled maritime workforce. The State of Alaska support of OCS development is a key arena for intervention to expand the economic opportunities and the need for a skilled workforce. One economic analysis of OCS development in the Chukchi and Beaufort seas indicated 35,000 new jobs could be created over the next 50 years.

35. The existing population in Alaska cannot meet the potential demand for a skilled workforce. The existing population available for training is insufficient to meet the need for the replacement of an aging workforce, or to capture skilled OCS jobs if and when they emerge.

36. The Alaska Arctic Policy Commission report makes numerous references to the need for a future maritime workforce to support spill response, offshore development, search and rescue, and marine navigation. Five key industries have been

identified where maritime infrastructure requires Arctic training and expertise: commercial shipping, commercial fishing, offshore hydrocarbon development, the cruise ship industry and mining.

RECOMMENDATIONS OF THE PROJECT

Near-term (2015-2023)

1. **U.S. Coast Guard:** Working with the State of Alaska fully implement the IMO Polar Code in the U.S. maritime Arctic meeting the 1 January 2017 date imposed for the Code to enter into force.
2. **State of Alaska & University of Alaska:** Develop strategic partnerships with commercial and research/university interests in Norway and Singapore related to offshore development, emergency response, and Arctic marine transportation issues.
3. **Alaska's Fishing Industry:** Explore the economic opportunities for trade with Europe by shipping products during the summer navigation season along the Northern Sea Route.
4. **Aleut Corporation and City of Adak:** Enter into discussions with Russian gas authorities in the Yamal to explore the economic feasibility of shipping gas to Adak along the NSR in summer for further distribution to communities in western Alaska.
5. **State of Alaska:** Establish a Task Force, including industry and federal representatives, to explore the funding of Arctic marine infrastructure using all forms of public-private partnerships. Include in the discussions strategies for funding an Arctic port.
6. **State of Alaska:** Fund and conduct a comprehensive indigenous marine use survey as called for in the Arctic Council's Arctic Marine Shipping Assessment. Compile all available data from local communities, industry, State agencies, and Federal agencies.
7. **State of Alaska:** Establish a position for an Arctic marine transportation coordinator on the Governor's staff or within a State of Alaska Department. The coordinator would track Arctic transportation trends and develop strategies for Arctic marine infrastructure working with a host of stakeholders and actors including Federal agencies, industry and foreign partners.

8. **NOAA/NOS:** Work with the State and other Federal agencies to ensure that hydrographic survey plans take in account the needs of Arctic coastal ports and communities. Regional marine charts are crucial to the facilitation of economic development in many coastal communities.
8. **State of Alaska:** Determine long-term funding to enhance marine domain awareness in Alaska's waters. One element would be to continue as a user and co-funder of the Marine Exchange of Alaska. Future marine traffic data will be critical to the long-term environmental economic security of the State. standards for a certified ice navigator.
3. **State of Alaska and Offshore Industry Partnership:** Develop a joint strategy for training workers for the potentially expanding offshore hydrocarbon developments. Involve all State training programs and the University of Alaska system.

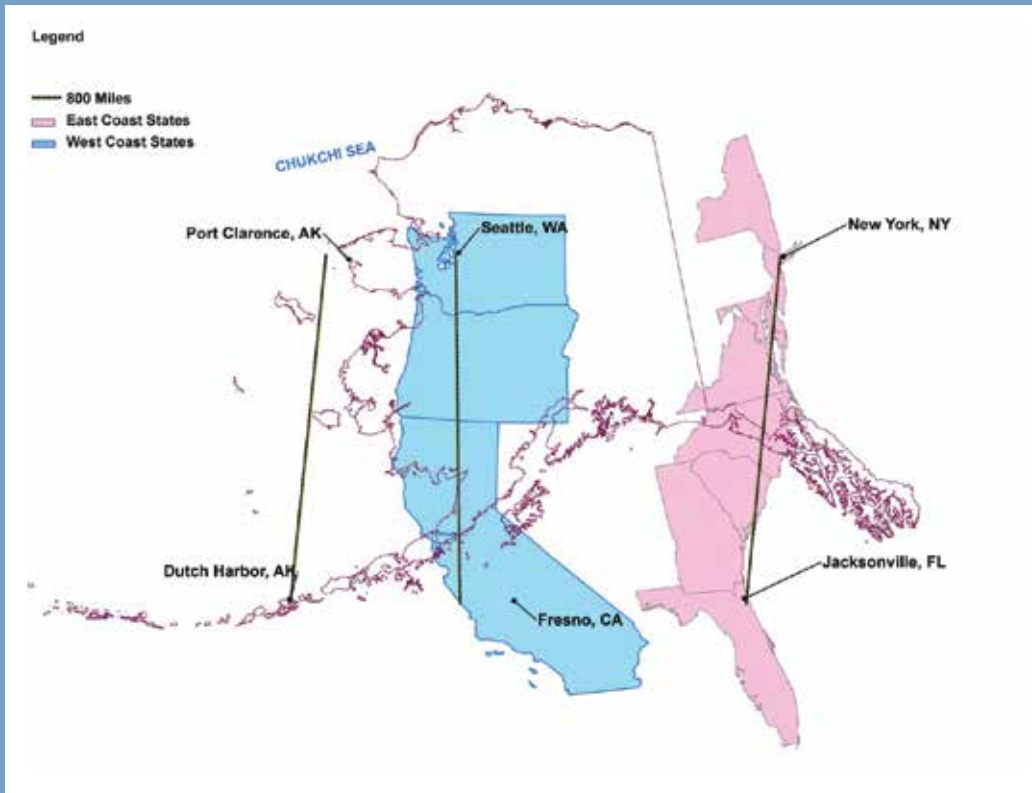
Long-term (2024-2035)

1. **State of Alaska:** Develop a comprehensive strategic plan for intermodal transportation networks to link with an Arctic port that focuses on the export of Alaska's natural resources (offshore and onshore) to global markets.
2. **Maritime Industry and State of Alaska Partnership:** Establish a joint task force to study the opportunities and economic benefits of using the Northern Sea Route for longer seasons of navigation for trade and the movement of natural resources during the summer. Invite the participation of Russian icebreaker companies and administrators to work with interested parties in enhancing trade to/from Alaska.



Shell Gulf of Mexico Inc.





Alaska District, U.S. Army Corps of Engineers

School of Natural
Resources and Extension
University of Alaska Fairbanks
P.O. Box 757140
Fairbanks, AK 99775 USA
Ph: 1-907-474-7083
www.uaf.edu/snre/

Comparison of Alaska's Vast Coastline with the U.S. East and West Coasts.